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ABSTRACT

This paper reports on the development and evaluation of "WoundCare: an Interactive Learning Program for Health Professionals" (trial version). The major goal of this project was to develop an interactive multimedia application that could be used by student nurses to enhance learning related to the assessment and treatment of people with wounds of various types. Specifically, the project aimed to develop an interactive multimedia application that could reduce the impact of problems associated with traditional methods typically used when teaching student nurses how to assess and treat people with wounds. A key issue examined in this paper is the extent to which the learning activities incorporated in educational multimedia, such as WoundCare, promote deep rather than surface learning. Specific design features thought to facilitate and inhibit deep learning are identified. Modifications that could increase the learning effectiveness of WoundCare and other interactive multimedia programs are proposed. (Contains 12 references.) (AEF)

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Using "WoundCare" to Learn

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Abstract: This paper reports on the development and evaluation of "WoundCare: An Interactive Learning Program for Health Professionals" (trial version). A key issue examined in this paper is the extent to which the learning activities incorporated in educational multimedia, such as WoundCare , promote deep rather than surface learning. Specific design features thought to facilitate and inhibit deep learning are identified. Modifications that could increase the learning effectiveness of WoundCare and other interactive multimedia programs are proposed.

Major goals and basic approach

The major goal of this project was to develop an interactive multimedia application that could be used by student nurses to enhance learning related to the assessment and treatment of people with wounds of various types. Specifically, the project aimed to develop an interactive multimedia application that could reduce the impact of problems associated with traditional methods typically used when teaching student nurses how to assess and treat people with wounds. The trial of "WoundCare: An Interactive Learning Program for Health Professionals" (trial version) has also led to a detailed examination of the educational value of the constitutive components of the program. In totality, the project consisted of an analysis of student needs and educational problems, the design and staged development of an interactive multimedia application, and, a comprehensive evaluation of the application and activities engaged in by students using the product in the context of learning.

Previous work

The impetus for developing WoundCare derived from contextual and practical difficulties associated with teaching wound assessment and management to student nurses using traditional methods. The major educational problem identified prior to this project was the ongoing difficulty nurse educators have representing clinical reality in university clinical nursing laboratories when teaching student nurses. Furthermore, it was recognised that use of WoundCare by student nurses had the potential to reduce the impact of practical problems including:

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und a bed or trolley to observe demonstrations;

- lecturers being unable to adequately supervise several sub groups of students practicing the clinical

sment activities; and,

- inability to provide similar learning experiences to distance education students unless on campus residential

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campus computing facilities) was intended to improve students' cognitive, technical and psychological

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y assert that it can be used to improve learning outcomes. Factors that may contribute to improved learning outcomes when interactive

possibility of accommodating different learning styles

But, do learning outcomes always improve when interactive multimedia is used? Of course, the realistic answer to this question is 'no'. It therefore becomes necessary to identify the features of interactive multimedia that consistently improve learning outcomes. Particularly important is whether a sequence of educational activities will stimulate deep rather than surface or shallow learning, i.e. thorough understanding rather than the capacity to recall isolated facts (Marton & Säljö 1976a, 1976b). Biggs (1999) argues that promoting deep learning rather than surface learning in tertiary education necessitates educational activities that require students to use both higher order and lower order learning activities. Table 1 presents Biggs' classification of common university level learning activities.

Recent discourse related to interactive multimedia indicates that poor design will often stimulate shallow learning rather than deep learning. An interactive multimedia application that requires little more than clicking on a button to advance from one page to the next exhibits passive interactivity and promotes shallow learning (Sims, 1994). By contrast, an activity that requires the creation of multimedia demands deep learning (Tuovinen 2000). If interactive multimedia is to improve student learning it must be designed to encourage deep rather than shallow learning.

Table 1: Deep vs. Surface Learning Activities, based on (Biggs, 1999, p.55)

Deep Learning Activities	**Surface Learning Activities**
Reflect	--------
Apply: far problems	--------
Hypothesize	--------
Relate to principle	--------
Apply: near problems	--------
Explain	--------
Argue	--------
Relate	--------
Comprehend: main ideas	--------
Describe	Describe
Enumerate	Enumerate
Paraphrase	Paraphrase
Comprehend sentence	Comprehend sentence
Identify, name	Identify, name
Memorize	Memorize

Materials developed

Early in the development process it was recognised that WoundCare could promote deep learning if it was designed appropriately. WoundCare consequently consists of a multimedia information resource (the InfoBase), Tutorials and a Case Study developed using the Authorware Attain (Macromedia Inc.) multimedia development application. Some screen dumps from the WoundCare application have been included in the Appendix.

The InfoBase included in WoundCare contained textual information, tables, diagrams and photographs for one hundred and eighty topics related to wound assessment and treatment. The topics cover skin anatomy and physiology, infection control, wound healing, assessment of people with wounds, wound status assessment, wound types, wound aetiology, wound healing inhibitors, wound cleansing, wound debridement, wound closure and wound dressing. It was intended that students use material included in the InfoBase to complete the Case Study and the Tutorials. Most of the keywords necessary to complete the Case Study were embedded in the textual material included in the InfoBase. The InfoBase information could also be used by students during relevant practical class activities, while preparing for examinations and caring for people with wounds during clinical fieldwork. While students could look up information in the InfoBase directly, such an activity in isolation from work on the Tutorials and Case Study was not expected to contribute significantly to deep learning.

study. It was anticipated that the structure provided by the objectives and topic listings would assist students to contextualise their study

The four major sections of the Case Study included in WoundCare were intended to promote deep learning of clinical reality. The History section of the Case Study set the scene by presenting a brief case history and photographs of a wound attributed to the t assessment data, which enabled them to specify diagnoses and treatments. The Case Study currently included in 'examining' the person with the wound and 'assessing' the wound itself. Students undertaking these activities had When students thought they had sufficient assessment data they could proceed to the Diagnosis section of the students entered valid keywords in the relevant text entry fields in the Diagnosis section of the Case Study, the Case Study required students to identify appropriate treatments for controlling wound healing inhibitors, wound cleansing, wound deb

whether the treatments specified were correct.

commands embedded in permanent and temporary drop down menus. Additional navigation aids included buttons that allowed students to move between multiple pages of text, tables, diagrams or photographs available ials or Case Study to view pages in another component of WoundCare was automatically displayed when students returned to that component of the by using the relevant menu commands.

Validation

After ensuring that the operation of WoundCare was reliable, an educational evaluation of the program was conducted with student and peer reviewers. This paper presents a report derived from the students' evaluations

- determine whether use of WoundCare promoted deep learning rather than surface learning;
  identify features of WoundCare that contribute most to deep learning; and,
  identify that interfere with deep learning.

Sample

The sample for the trial of WoundCare was a convenience sample that included thirty five second year university pre registration nursing students who voluntarily consented to participate. There were thirty female

mpleted a major two part assignment related to wound assessment and management. Each student was also supplied with a copy of WoundCare on CD ROM and an instruction sheet. The software was also installed on computers located in the clinical nursing laborat laboratories. It was anticipated that students would engage in activities intended to promote deep learning including self directed use of WoundCare (especially completion of the Tutorials and Case Study), preparation -Part A), and a small group multimedia creation activity -Part B).

ta were extracted from written reviews submitted to satisfy requirements for Assignment- -trial

questionnaires, diaries, post-trial questionnaires and diagnostic tests. Verbal data obtained from the written reviews of WoundCare (Assignment-Part A) and the open-ended items included in the initial questionnaire, diary and final questionnaire were thematically analysed. Particular attention was paid to classifying the student activities as they engaged with the multimedia according to the Biggs deep and surface learning categories shown in Table 1. Quantitative data derived from the initial questionnaire, diary and final questionnaire were analysed statistically.

Results and Discussion

The trial participants thought that the WoundCare program was relevant to them, registered nurses and other health care workers. The most common reasons for this were that the InfoBase included a large amount of clinically relevant information supported by photographs and other media, and that they could actively work through a clinically-oriented Case Study. Many participants felt the program was easy to use and the instructions and help available were adequate, but an equivalent number thought that WoundCare was either difficult to use or that there was insufficient direction (particularly for completion of the case study). Many participants thought the current navigation using permanent and temporary menus should be changed. Some participants indicated that navigation buttons and hypertext would be better. Some participants thought that it was important to be able to display InfoBase information in a separate window to the Tutorial or Case Study when they were trying to complete these activities. A large number of participants indicated that the interface could be enhanced dramatically by using different colors, borders or background image. It may be that the structural and cosmetic changes being suggested by participants would reduce observable split attention effects and decrease extraneous cognitive load thus maximising the working memory available for the specific learning task being undertaken (Sweller, van Merriënboer, & Paas 1998).

The problem of a computer program failing to recognise text entries is a difficulty frequently encountered when developing interactive multimedia. While the text-matching using wild characters feature of the multimedia authoring program, AuthorWare Attain (Macromedia, Inc.), helped improve recognition of student text entries, some students reported mismatches and an unacceptable number of unrecognised entries. Possible strategies for reducing mismatches and unrecognised entries include capturing student entries and updating the database of recognisable text entries. It may also be possible to improve the communication between the program and its user by including a clarification process when the computer is not sure of a user's meaning.

The available qualitative and quantitative data highlight the difference between deep and surface learning and how simulation may be used to encourage engagement and deep learning. Detailed analysis of this data indicates that use of the InfoBase alone and completion of the Tutorials were not sufficiently challenging and therefore were not thought to contribute substantially to deep learning. This is supported by the suggestion by many students that the Tutorials should include review or test questions. Such suggestions also indicate a need to stimulate greater engagement with the program. Conversely, the Case Study, elicited the most intense mental engagement, motivation and presented the most formidable challenges for students using the program. It may be, however, that the Case Study was *too demanding* for some students, as several commented negatively on its level of difficulty, the time required to complete it, the lack of example questions, the lack of preparatory Case Studies or exercises, and the lack of realism. Consequently, both mechanisms included in WoundCare to promote deep learning, the Tutorials and the Case Study, could be improved.

The trial participants' views regarding the small group multimedia creation activity (Assignment-Part B) were varied. While many participants thought that the activity was too demanding, some indicated that it was an appropriate and enjoyable activity. The variable quality of submissions did, however, suggest that this task may have been too difficult for many student nurses.

Limitations

One major limitation of this evaluation was that the evaluation and teaching described here were carried out by the developer of WoundCare. Additional limiting factors associated with the lack of anonymity of participants are possible excessive student compliance and sample bias. It should also be noted that these factors and student workloads could have contributed to the attrition that was observed during the study-while 100% of participants completed the initial questionnaire and written review, only 22-35% of participants completed the logbook, final questionnaire and/or diagnostic test.

Future work and implications

The experience of developing and evaluating "WoundCare: An Interactive Learning Program for Health Professionals" has been a learning experience for all who have been involved in the project (1997-2000). It is easy to identify things that could have been done differently in order to expedite the development process or improve the end product. The student evaluation indicates that the current version of the WoundCare is robust, relatively easy to use, despite its identified limitations, and includes activities and material that can facilitate deep learning. From a developer's perspective WoundCare is relatively easy to expand and modify using the AuthorWare Attain (Macromedia Inc.) multimedia development environment. Nevertheless, the results of the evaluation reported here indicate that there are some significant problems that could inhibit deep learning.

Firstly, the student activities may not have led to deep learning because they were not sufficiently engaging. For example, WoundCare tutorials encouraged students to read InfoBase information but there were no questions to stimulate deep learning and give feedback to the learner. Thus if we examine Table 1, the tutorial activities and interactions should e ·ourage more of the high demand mental processes in the first column.

Secondly, deep learning coul have been impeded by design features that resulted in extraneous cognitive load, split-attention effects, reduced interaction effectiveness and reduced motivation (Sweller et al. 1998). For example, extracting, integrating and applying information derived from multiple places in the WoundCare InfoBase in order to complete the Case Study requires intensive use of available cognitive resources and is therefore very demanding (Chandler & Sweller 1992). The interactive Case Study was considered to be an appropriate type of challenge but may have been too cognitively demanding. Student progression through a series of increasingly difficult learning activities prior to attempting the existing Case Study may reduce the cognitive demands the activity currently requires.

Thirdly, the success or failure of multimedia in education may not be due to the inherent features of the program itself, rather to a creative or inappropriate use of the materials. For example, one of the student activities associated with the use of WoundCare by students was the specification of data for a new case study that could ultimately be incorporated into the program. As previously noted, this was a very demanding activity that again required students to extract, integrate and apply information derived from multiple places in the WoundCare InfoBase. Students could also use other sources of information if required. The activity associated with seeking and processing information in order to formulate case study data appropriate for an imaginary person with a particular wound and present an appropriate justification again required intensive use of cognitive resources (Tuovinen 2000). With hindsight, it may have been better to provide students with completion exercises, where part of the multimedia creation task had already been done and they needed to fill in the gaps (Paas 1992; Sweller 1999).

These problems reinforce the view that developers must give serious consideration to the level of processing expected of students when they participate in learning activities requiring the use of interactive multimedia. The results of this evaluation of WoundCare have established the need to:

- improve the aesthetic appearance;
- incorporate buttons and hyperlinks to make navigation more intuitive;
- develop and incorporate tutorial review questions and diagnostic tests;
- develop and incorporate additional case studies (with varying levels of difficulty);
- review feedback mechanisms and content; and,
- prepare additional InfoBase content and media.

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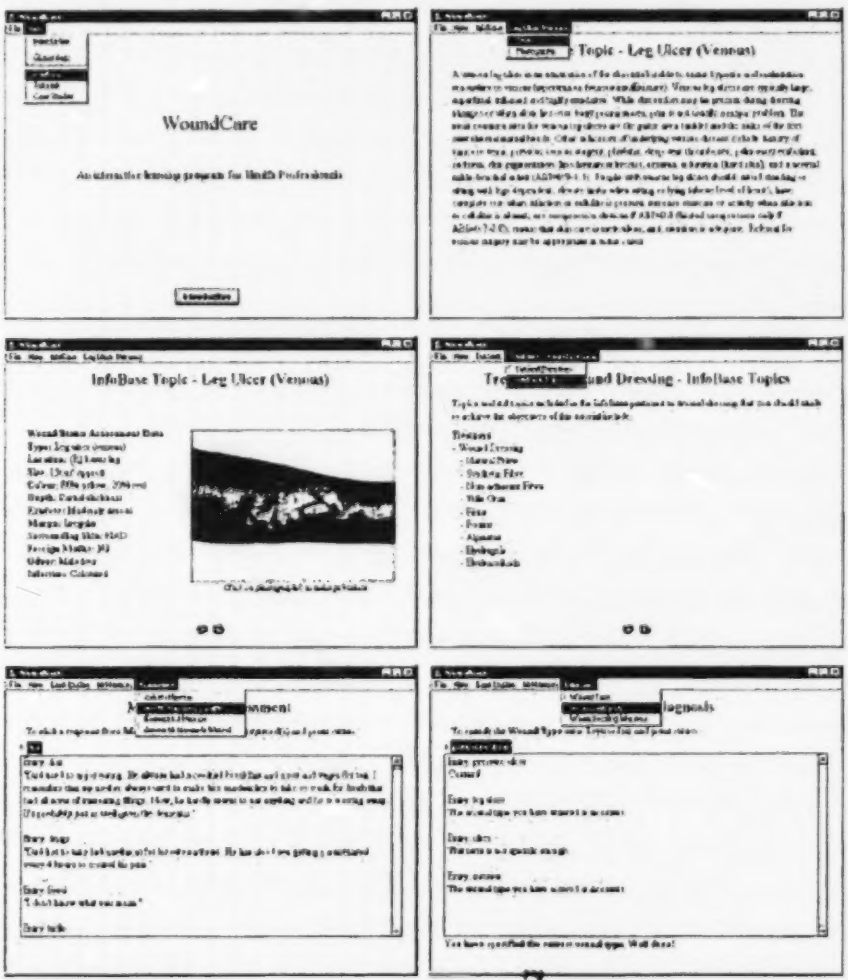
Appendix: Sample Screens from WoundCare



These images show that navigation throughout WoundCare was achieved using menus and some buttons. The upper left image on this page shows the title page. The upper right image and middle two images show pages from the InfoBase with text and a wound photograph. The lower two images show sample text entry and response fields included in the Case Study.

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